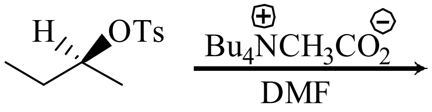
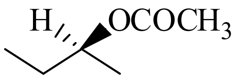
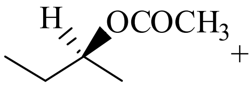
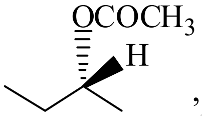
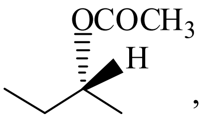
DPP- (1) Reaction Mechanism

1. Find the product and type of reaction



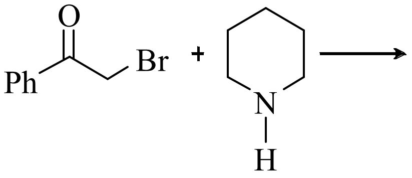
(a)  , S_N2 reaction

(b)  +  , S_N1 reaction

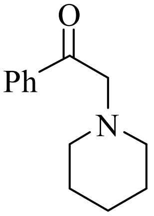
(c)  , S_N2 reaction

(d) None

2. Find the incorrect statement?



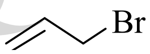
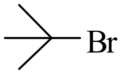
(a) S_N2 reaction take place there

(b) Product of the reaction is 

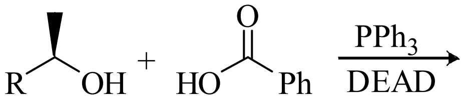
(c) Rate of reaction is depend on the concentration of substrate

(d) Rate of reaction is independent of concentration of Nucleophile

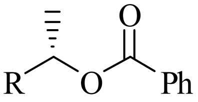
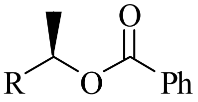
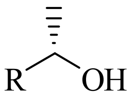
3. Rate of S_N2 reaction is fastest in following substrate.

(a)  (b) (c)  (d) $CH_3 - CH_2 - Br$

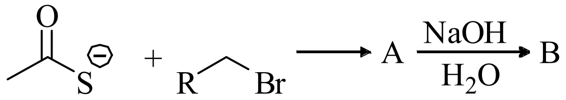
4. Find the major product?

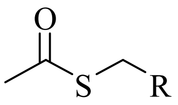


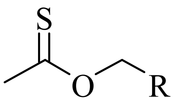
QUANTA CHEMISTRY

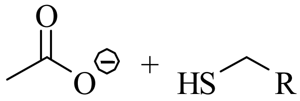
(a)  (b)  (c)  (d) None of these

5. Find the correct statement



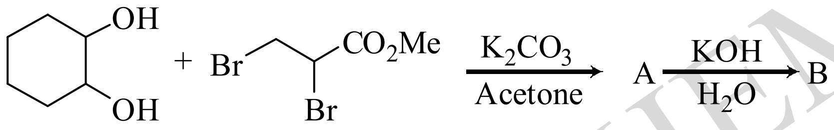
(a) A is 

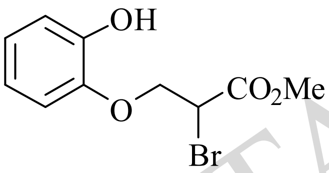
(b) A is 

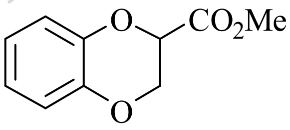
(c) B is 

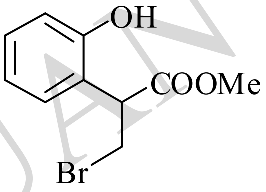
(d) S_N2 reaction take place there

6. Find the incorrect statement.



(a) A is 

(b) B is 

(c) A is 

(d) In both cases S_N2 reaction take place

7. Find the incorrect order of nucleophilicity.

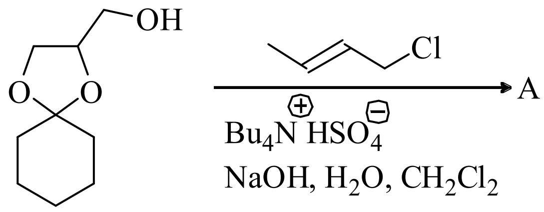
(a) $I^{\ominus} > Br^{\ominus} > Cl^{\ominus}$ in H_2O

(b) $Cl^{\ominus} > Br^{\ominus} > I^{\ominus}$ in DMSO

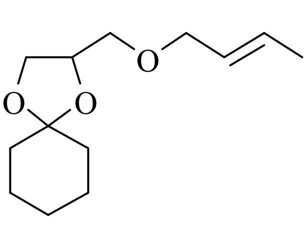
(c) $CH_3O^{\ominus} > PhO^{\ominus} > CH_3CO_2^{\ominus} > NO_3^{\ominus}$

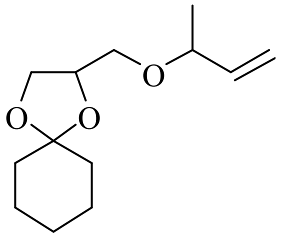
(d) $NH_2^{\ominus} < OH^{\ominus} < F^{\ominus}$

8. Find the incorrect statement



QUANTA CHEMISTRY

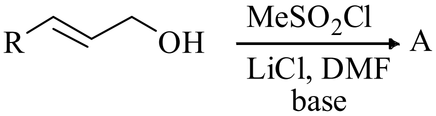
(a) A is 

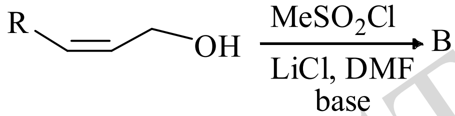
(b) A is 

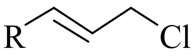
(c) It is a example of S_N2 reaction

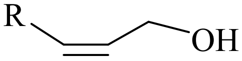
(d) It is a example of S_N2' reaction

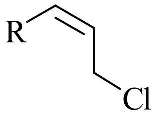
9. Find the major products.

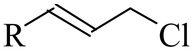
(i) 

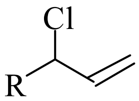
(ii) 

(a) A is 

; B is 

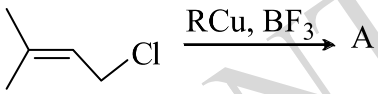
(b) A is 

; B is 

(c) A & B is 

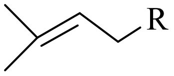
(d) It is an example of S_N2 reaction

10. Find the major product and type of

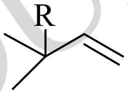


(a)

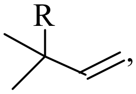
, S_N2 reaction

(b) 

, S_N2' reaction

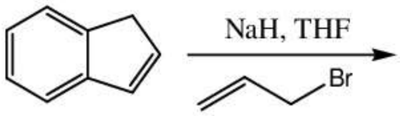
(c) 

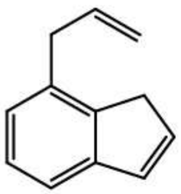
, S_N2 reaction

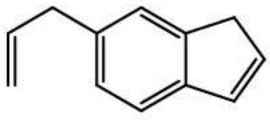
(d) 

, S_N2' reaction

11. The major product formed in the following reaction is:



(a) 

(b) 

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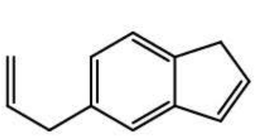
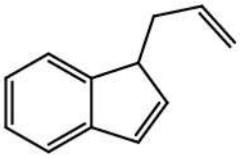
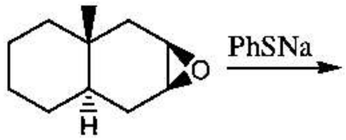
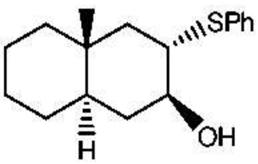
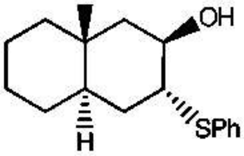
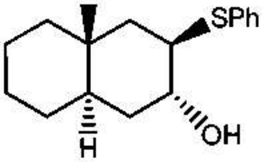
(c)  (d) 

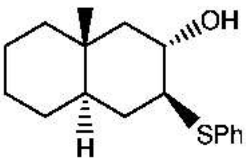
12. The major product formed in the following reaction is



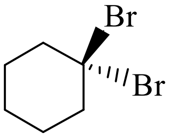
(a) 

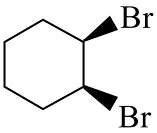
(b) 

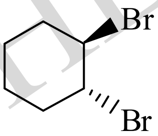
(c) 

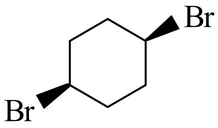
(d) 

13. Among the following dibromocyclohexanes, the one that reacts fastest with sodium iodide to give cyclohexene is **(June 2013)**

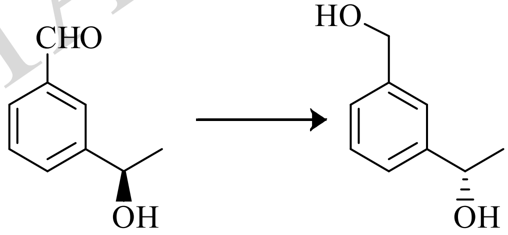
(a) 

(b) 

(c) 

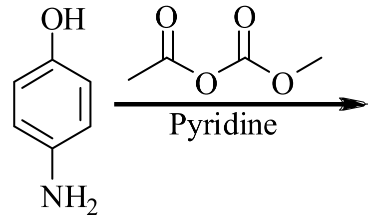
(d) 

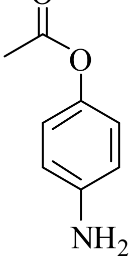
14. The correct combination of reagents to effect the following reaction is

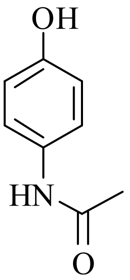


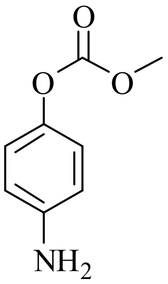
(a) A. $POCl_3$, pyridine; B. AgOAc; C. $LialH_4$ (b) A. $NaBH_4$; B. Ph_3P, DEAD, $PhCO_2H$
(c) A. Ph_3P, DEAD, $PhCO_2H$; B. $LiAlH_4$ (d) A. PCC ; B. L – selectride

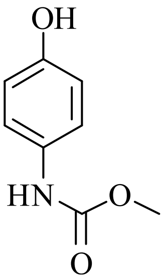
15. The major product formed in the following reaction is



(a) 

(b) 

(c) 

(d) 

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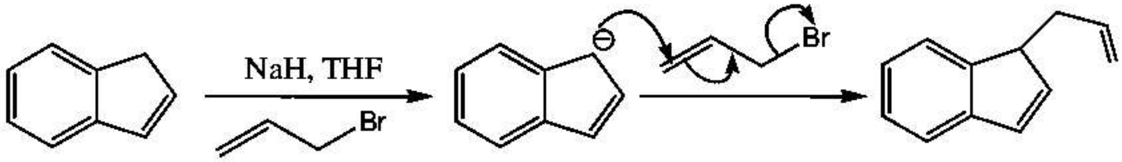
ANSWER KEY

1. c	2. d	3. b	4. a	5. b	6. a	7. d
8. b, c	9. a	10. d	11. d	12. b	13. **c**	14. c
15. b						

QUANTA CHEMISTRY

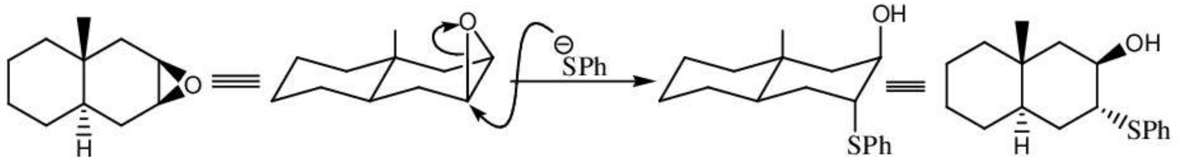
HINTS & SOLUTION

11. Chemical reaction involved in the above transformation can be illustrated as



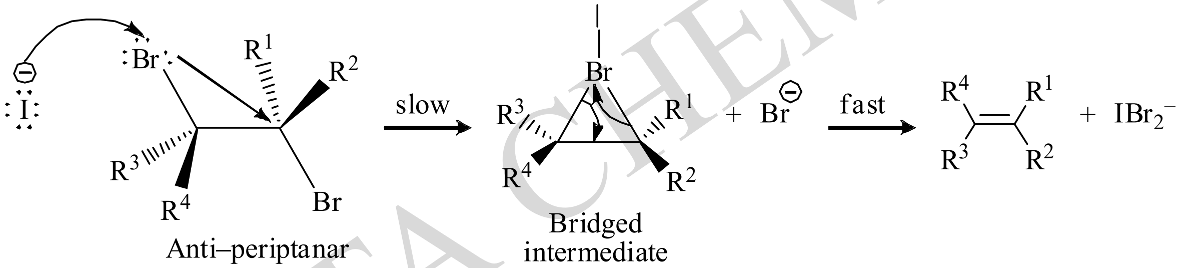
Correct answer is (d).

12. Chemical reaction involved in the above transformation can be illustrated as



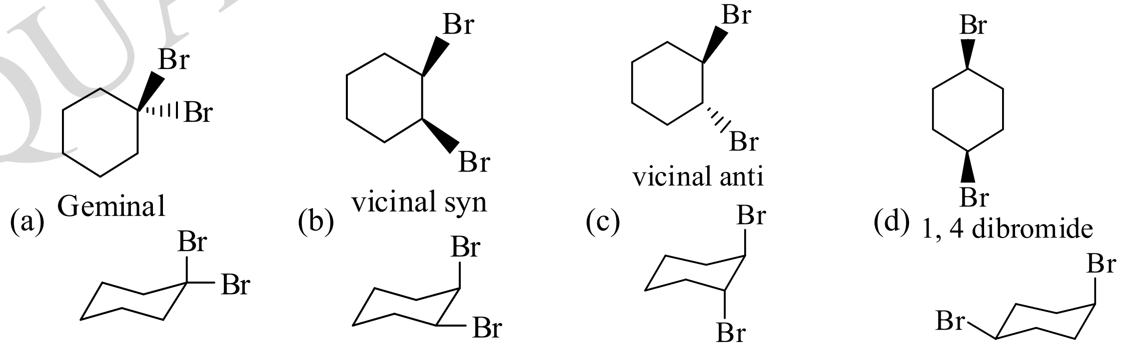
Correct answer is (b)

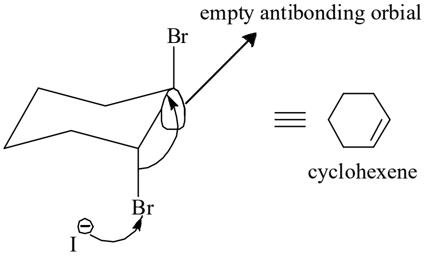
13. Vicinal dibromides may be dibrominated by treating them with reducing agenets like, Iodide ion or zinc. Debromination using sodium iodide is found to be an anti – elimination.



This iodine induced reduction is essentially the reverse of a halogenation. Application of the principle of microsope reversibility suggest that the reaction proceeds through a bridged intermediate as shown above.

Out of four options only (b) and (c) are vicinal and out of (b) and (c) only in (c) the two Br are anti thus the correct answer is (c)





Correct answer is (c)

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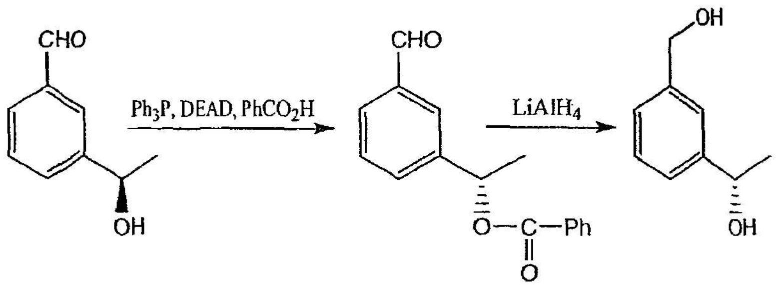
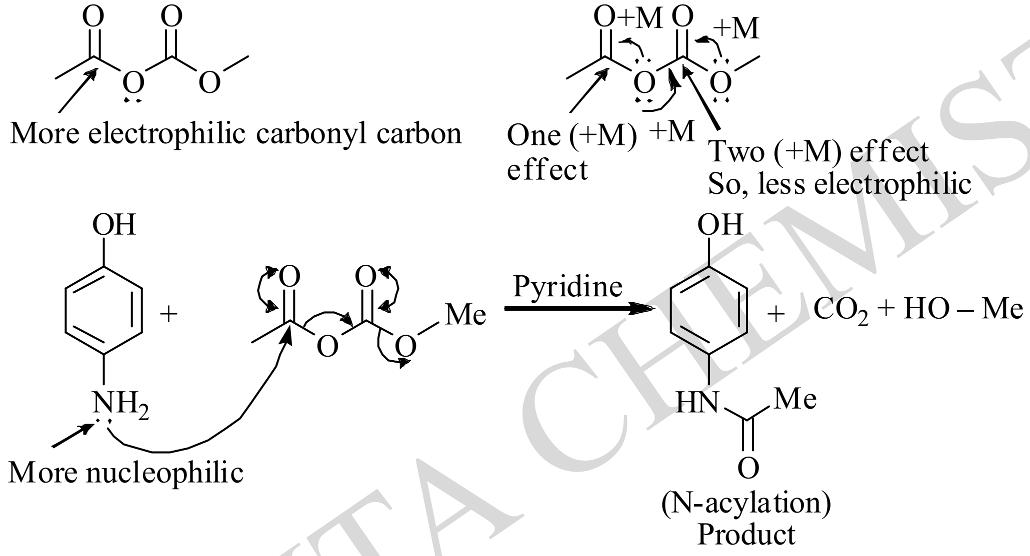
14. 

Correct option is (c)

15. Mixed anhydride as acylating agent



Correct option is (b)

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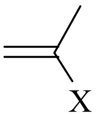
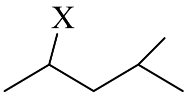
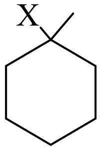
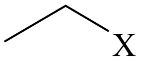
An Institute of Chemical Sciences

CSIR-NET | IIT-GATE | IIT-JAM | Other MSc. Entrance

DPP- (2) Reaction Mechanism

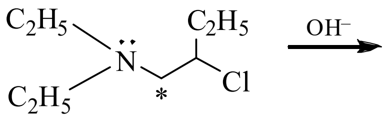
1. Which of the following shows the correct decreasing order of solvolysis with aqueous ethanol?

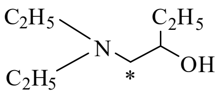
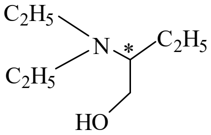
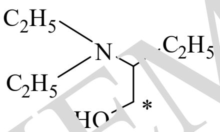
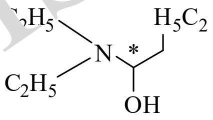
I.  II.  III.  IV. 

The correct choice is :

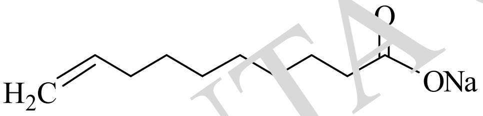
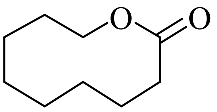
(a) III > II > I > IV (b) III > II > IV > I (c) II > III > IV > I (d) III > I > IV > II

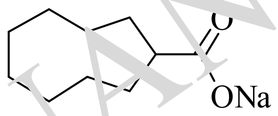
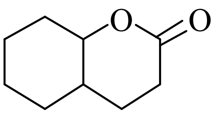
2. Trace the major product in the following reaction,



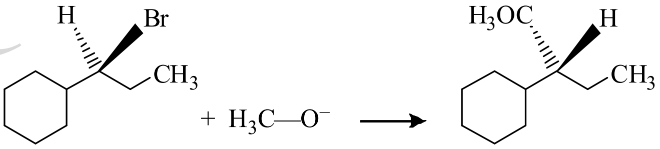
(a)  (b)  (c)  (d) 

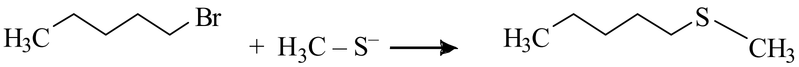
3. An open chain unbranched compound with molecular formula $C_9H_{17}O_2Br$(DBE = 1) turns blue litmus to red. This upon treatment with NaOH gives a product with expulsion of HBr. The DBE of the corresponding product now rises to 2. What should be the structure of the final compound?

(a)  (b) 

(c)  (d) 

4. Which of the following reaction will go faster if the concentration of the nucleophile is raised ?

(I) 

(II) 

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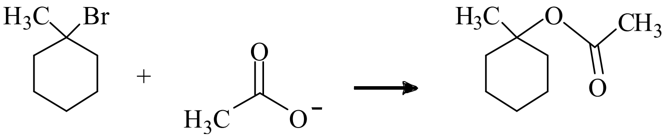
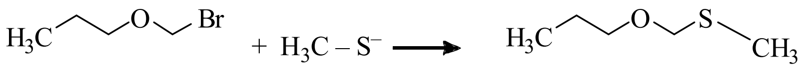
Address : 50 Mall Road, Near GTB Nagar Metro Station Gate No 3, Kingsway Camp, Delhi 110009
Contact Us : 9990382567, 7082062392, 9717373074, 8285815185

(III) 

(IV) 

(a) I and III (b) II and IV (c) I and II (d) I, II and IV

5. For the following reaction

$$CH_3-\underset{Cl}{\overset{CH_3}{C}}-CH_3 \xrightarrow[30\%\ H_2O]{70\%\ \text{Ethanol}} CH_3-\underset{OCH_2CH_3}{\overset{CH_3}{C}}-CH_3 + CH_3-\underset{OH}{\overset{CH_3}{C}}-CH_3 + CH_3-\overset{CH_3}{C}=CH_2$$

Which of the following statement is incorrect ?

(a) the rate of reaction depends only on the concentration of the *t*-butyl chloride

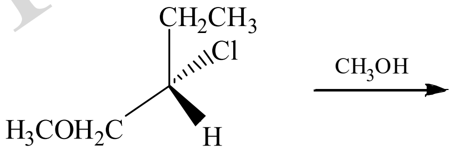
(b) the rate constant will remain same

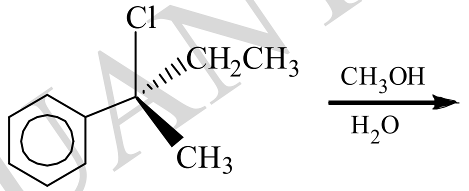
(c) the rate of reaction drops as *t*-butyl chloride is used up in the reaction

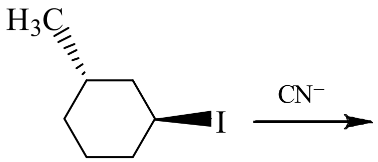
(d) the rate of reaction will become 1/4th as the concentration of *t*-butyl chloride become half

6. Which of the following reactions is likely to give four products including stereoisomers ?

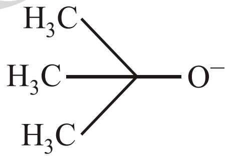
(a) $CH_3-\underset{CH_3}{\overset{CH_3}{C}}-CH_2-Cl \xrightarrow[H_2O]{AgNO_3}$

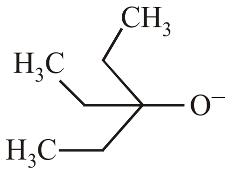
(b) 

(c) 

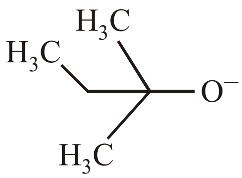
(d) 

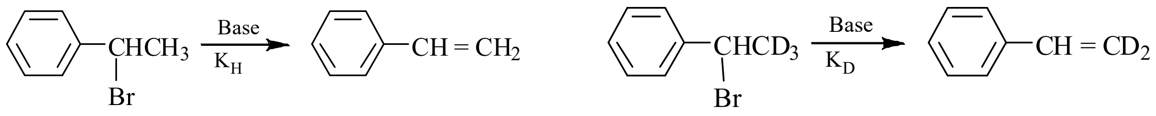
7. Which of the following bases would give the high percentage of alk-1-ene from 2-bromo-2, 3-dimethylbutane ?

(a) 

(b) 

(c) $H_3C-CH_2-O^-$

(d) 

8. 

Assuming both the reactions as E1, the expected ratio between K_H/K_D lies between

(a) nearly 1 (b) nearly 3

(c) nearly 5 (d) anything in between 2 to 8

9. Which of the following reactions cannot give both 'E' and 'Z' products ?

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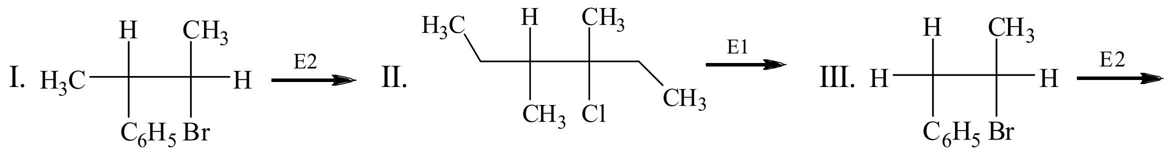
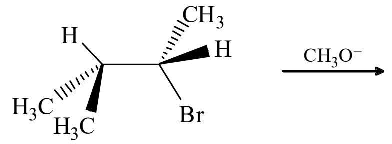
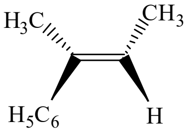
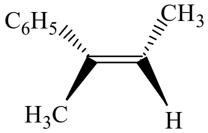
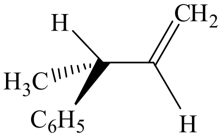
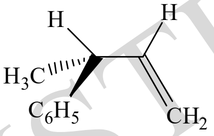


(a) II (b) III (c) I and II (d) II and III

10. Identify the product.



(a)  (b)  (c)  (d) 

11. Consider the following reaction

$$H_3C\text{—}\underset{\underset{X}{|}}{CH}\text{—}CH_2\text{—}CH_2\text{—}\underset{\underset{CH_3}{|}}{CH_2}\text{—}CH_3 \xrightarrow{CH_3O^-} \underset{\text{Product-1}}{H_3C\text{—}CH = CH\text{—}CH_2\text{—}CH_2\text{—}CH_3} +$$

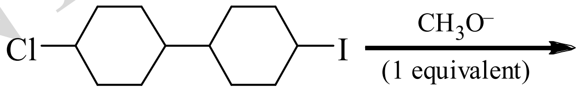
$$\underset{\text{Product – 2}}{H_2C = CH\text{—}CH_2\text{—}CH_2\text{—}CH_2\text{—}CH_3}$$

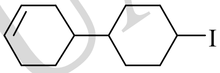
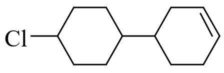
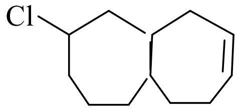
The ratio between product-1 and product-2 is _________ .

(a) 1 : 4 when X is I (b) 1 : 4 when X is Br

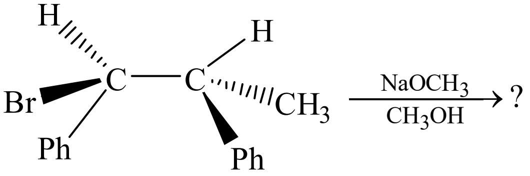
(c) 1 : 3 when X is Cl (d) 1 : 3 when X is F

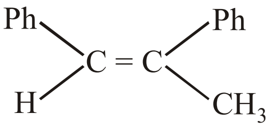
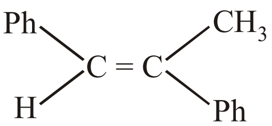
12. Predict the product for the following elimination reaction

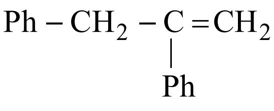
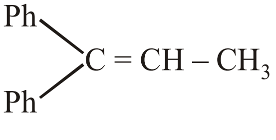


(a)  (b)  (c) (d) 

13. The following substrate can give rise to which of the following product ?



(a)  (b) 

(c)  (d) 

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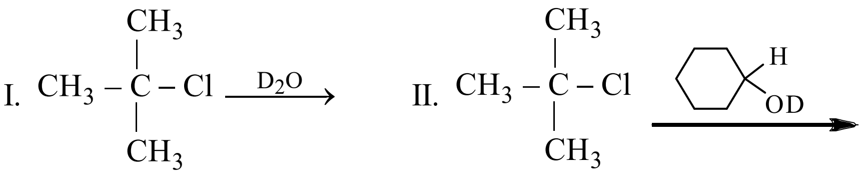
14. 

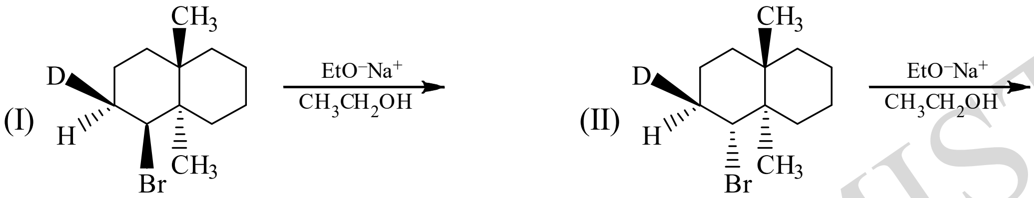
Select the correct statement about the products of E_1 reactions.

(a) Both would give deuterium incorported products

(b) Reaction I would give deuterium incorporated product but II would not

(c) Both would give identical products

(d) Reaction II would give an ether

15. 

In which of the above reaction(s), deuterium will be lost in the product ?

(a) Reaction I (b) Reaction II (c) Both (d) None

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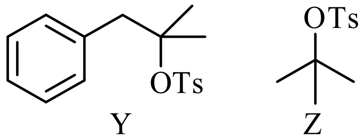
ANSWER KEY

1. b	2. c	3. b	4. c	5. d	6. c	7. b
8. a	9. a	10. a	11. d	12. b	13. b	14. a
15. b						

DPP- (3) Reaction Mechanism

1. In S_N1 reaction, racemisation occurs if the reaction occurs at a stereogenic centre, however 50 : 50 mixture of enantiomers rarely obtained, why?
   (a) Usually one enantiomer is more stable than other.
   (b) Retention of configuration is always favoured in reaction.
   (c) Hydroxylic solvent favour retention of configuration.
   (d) There is steric hinderance to the approach of nucleophile from the front side as some of the leaving group are not completely. Which favours inversion of configuration.

2. From the following, pick out the explanation for why molecule Y hydrogens faster than molecule Z.

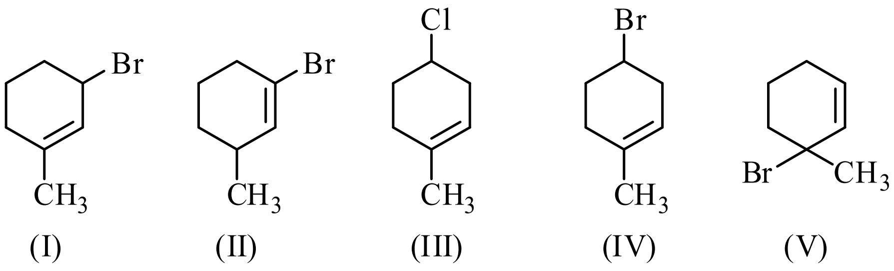


   (a) Less steric hindrance in Z (b) Less steric hindrance in Y
   (c) Greater carbocation stability (d) Better solvent

3. Which step in S_N1 reaction is a slow rate determing step?
   (a) Attack of Nucleophile (b) Formation of a racemic mixture
   (c) Formation of intermediate (d) All of the mentioned

4. Pick out the following factors which promote a S_N1 reaction.
   (i) Temperature (ii) Concentration of Nucleophile
   (iii) Concentration of alkyl halide (iv) Aprotic solvent
   (a) Both (i) & (ii) (b) Both (ii) & (iii) (c) Both (iii) & (iv) (d) Both (i) & (iii)

5. Rank the following molecules in increasing order of relative rate of S_N1 solvolysis with methanol and heat.



   (a) III < II < IV < V < I (b) II < III < IV < I < V
   (c) V < IV < III < II < I (d) II < III < IV < V < I

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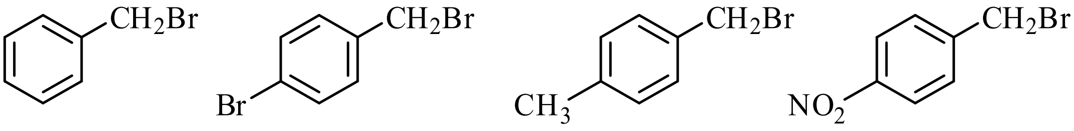
6. The most and least reactive electrophiles respectively in a S_N1 reaction are



(I) (II) (III) (IV)

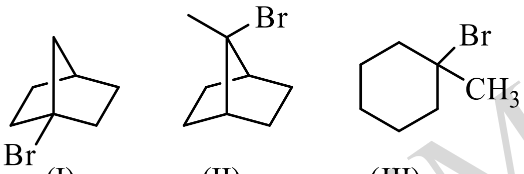
(a) Both I and II (b) Both II and III (c) Both I and III (d) Both III and IV

7. Which of the following reactions are favoured by polar aprotic solvent?

(a) S_N1 reactions (b) S_N2 reaction

(c) Both S_N1 and S_N2 reactions (d) None of the above

8. Which of the following alkyl halides is respectively most and least reactive in S_N1 reaction?



(I) (II) (III)

(a) I and II (b) II and III (c) III and I (d) I and II

9. Which of the following is true regarding a S_N1 reaction?

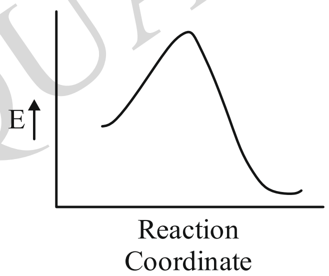
(a) It would be faster at 25° than at 50 °C.

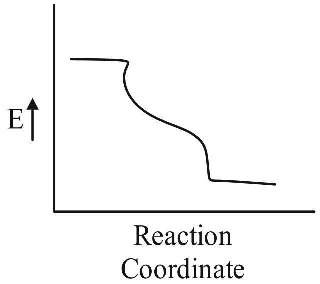
(b) It would be faster in ethanol than in pentane.

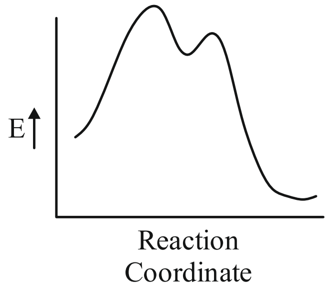
(c) Keeping the moles of reactants constant but doubling the quantity of solvent would decrease the rate by a factor to 4.

(d) Stereochemical inversion occurs exclusively.

10. From the following, pick out the potential energy profile for a S_N1 reaction.

(a)


(b)


(c)


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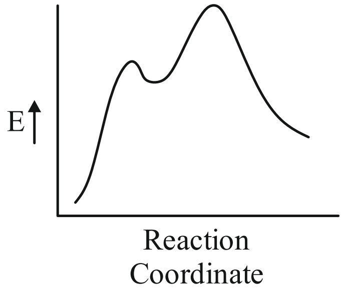

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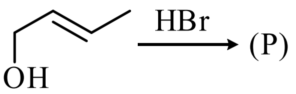
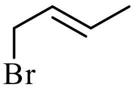
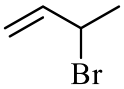
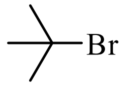
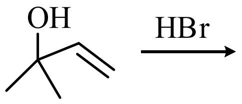
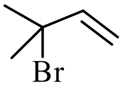
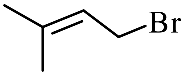
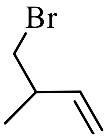
11. Find the major product?



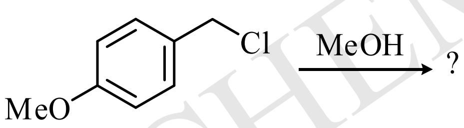
(a)  (b)  (c)  (d) None

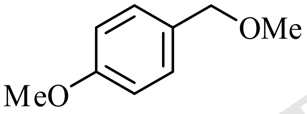
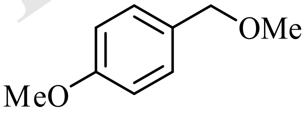
12. Find the major product?

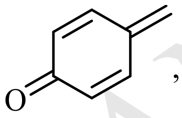
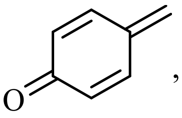


(a)  (b)  (c)  (d) None

13. Find the major product and type of reaction?



(a)  , S_N2 (b)  , S_N1

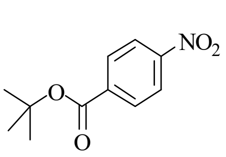
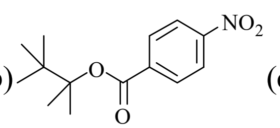
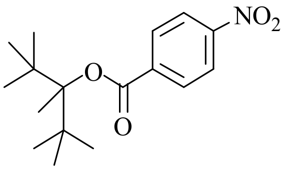
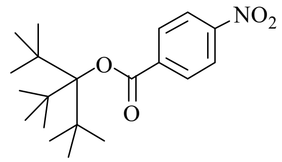
(c)  , S_N2 (d)  , S_N1

14. Order of nucleophilicity for S_N1 mechanism?

(a) $F^- < Cl^- < Br^- < I^-$ (b) $MeO^- > PhS^- > PhSe^-$

(c) $MeO^- \approx PhS^- \approx PhSe^-$ (d) None

15. Among the following, the compound that will have highest rate for nucleophilic substitution through S_N1 mechanism is

(a)  (b)  (c)  (d) 

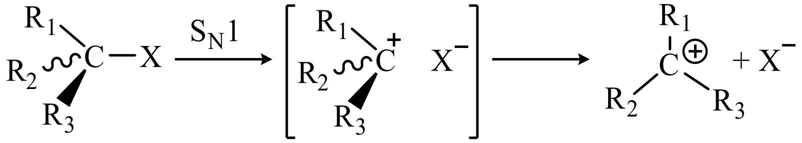
ANSWER KEY

1. d	2. c	3. c	4. d	5. b	6. d	7. b
8. c	9. b	10. c	11. a	12. b	13. b	14. c
15.d						

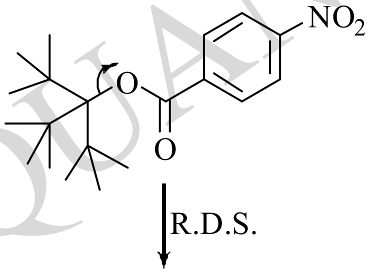
QUANTA CHEMISTRY

HINTS & SOLUTION

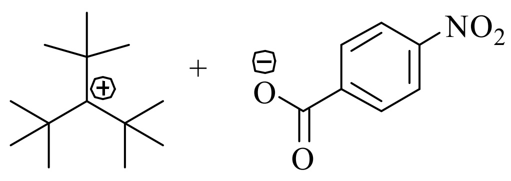
1. (d) In S_N1 reaction, some of the substrate, even after ionisation, remains associated as intimate ion pair preventing nucleophile attacks from front side and gives inverted product.



2. Y forms 3° carbocation which rearranges to a further more benzylic carbocation.
3. The first step of formation of the intermediate is a slow rate determining step in S_N1 reaction.
4. Increasing temperature increases rate of any reaction. Also rate of S_N1 reaction is directly proportions to concentration of alkyl halide but independent of nucleophile & aprotic solvent.
5. V is most stable 3° allylic carbocation, II is vinylic halide least reactive.
6. Electron donating $-CH_3$ group stabilises benzylic carbocation, hence increases reactivity of corresponding substrate electron withdrawing $-NO_2$ decreases stability of carbocation, decreases reactivity of corresponding substrate in S_N1 reaction.
7. S_N1 reaction are favoured by polar protic solvents whereas S_N2 reactions are favoured by polar aprotic solvent.
8. III forms tertiary carbocation hence most reactive, I is least reactive as highly unstable. Carbocation is formed at bridge head carbon of bicyclic compound.
9. Protic solvents solvate carbocation, promotes S_N1 reaction.
10. S_N1 reaction proceeds via carbocation intermediate which is being indicated have by two transition states and a small trough between reactant and product. Also the second transition state must be below first transition state in S_N1 reaction.

15. 

Three t-Bu groups make this substrate highly crowded/sterically hindered. Therefore, it will undergoes ionization to form carbocation in S_N1 reacction at highest rate among the given examples and show highest rate via S_N1 mechanism.



More relief after ionization

Correct option is (d)

QUANTA CHEMISTRY

DPP- (4) Reaction Mechanism

1. In the given reaction,

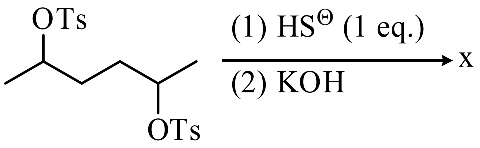
$$CH_3CH_2-\ddot{\underset{\cdot\cdot}{S}}-\overset{*}{C}H_2-CH_2-Br \xrightarrow{H_2O} x$$

x will be

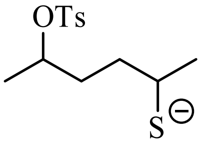
(a) $CH_3-CH_2-S-\overset{*}{C}H_2-CH_2-OH$ (b) $CH_3-CH_2-S-CH_2-\overset{*}{C}H_2-OH$

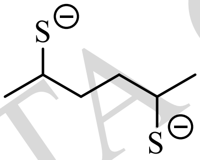
(c) 1 : 1 mixture of A & B (d) 2 : 1 mixture of A & B

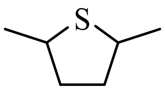
2. In the given reaction

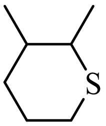


x will be

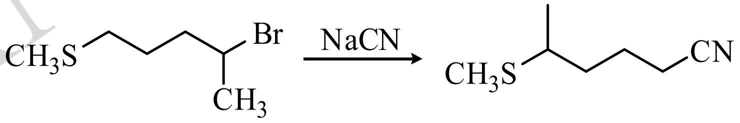
(a) 

(b) 

(c) 

(d) 

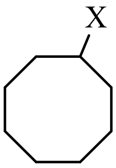
3. For the following reaction, pick out the best term which describe its mechanism:

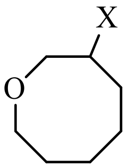


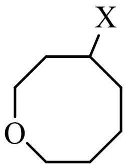
(a) S_N1 (b) S_N2

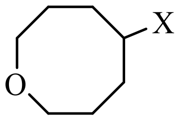
(c) S_N2 with NGP (d) Addition followed by substitution

4. Among the given molecular, the rate of solvolysis will be highest for

(a) 

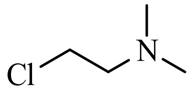
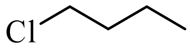
(b) 

(c) 

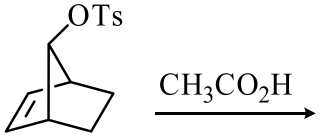
(d) 

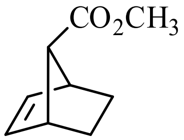
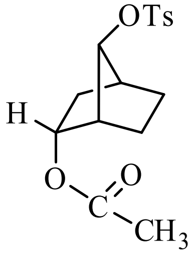
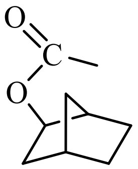
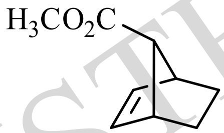
5. Which will undergo fastest solvolysis

QUANTA CHEMISTRY

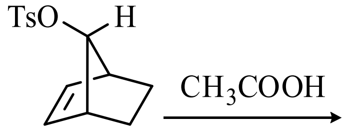
(a)  (b)  (c) Both (a) and (b) (d) Can't be predicted

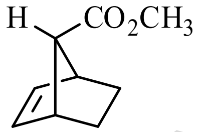
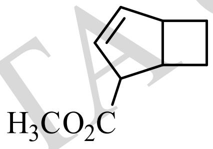
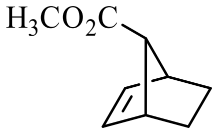
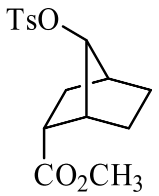
6. Predict the product of the following reaction



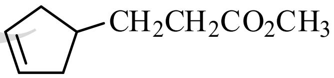
(a)  (b)  (c)  (d) 

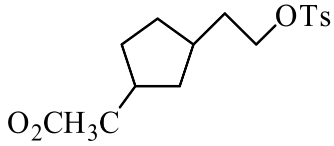
7. Predict the major product of the following reaction

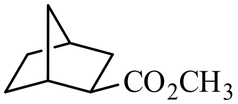


(c)  (b)  (c)  (d) 

8. Predict the major product of following reaction.

(a) 

(b) 

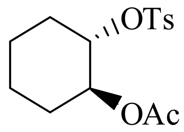
(c) 

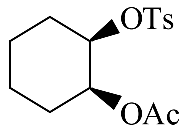
(d) Both (a) and (b)

CSIR NET PREVIOUS YEAR QUESTIONS

9. The correct statement about solvolysis using NaOAc/AcOH of following compounds is

(June 2018)


A


B

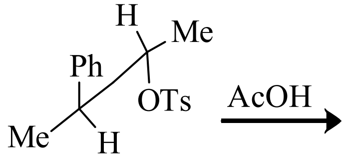
(a) A reacts faster than B to give trans – 1, 2 – diacetoxycyclohexane

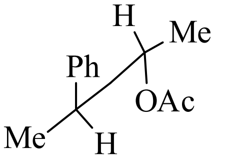
(b) B reacts faster than A to give trans – 1, 2 – diacetoxycyclohexane

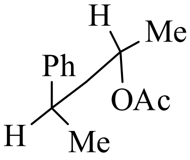
(c) A reacts faster than B to give cis – 1, 2 – diacetoxycyclohexane

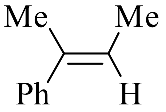
(d) B reacts faster than A to give cis – 1, 2 – diacetoxycyclohexane

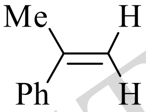
10. The major product formed in the following reaction is **(June 2014)**



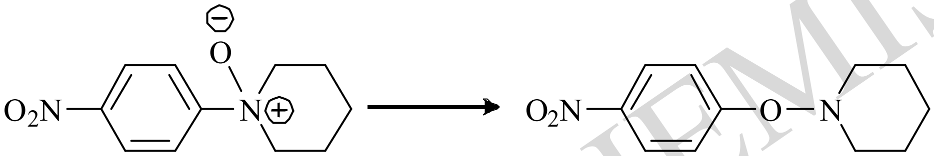
(a) 

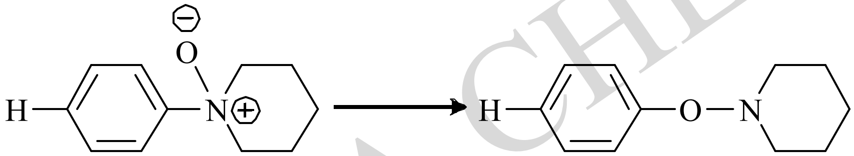
(b) 

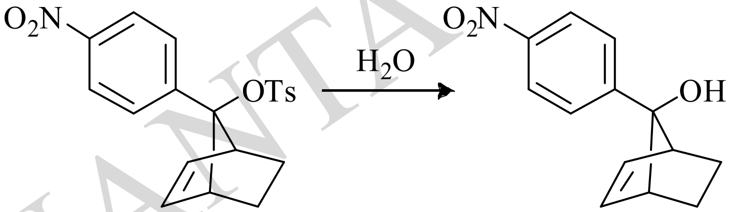
(c) 

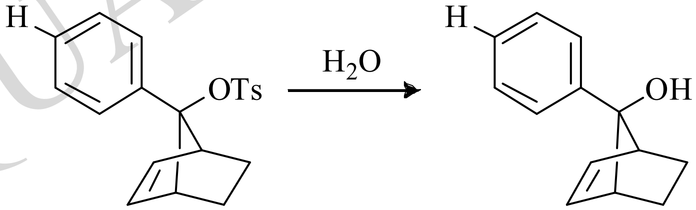
(d) 

11. For the four reactions given below, the rates of the reactions will vary as **(Dec. 2016)**

(1) 

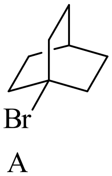
(2) 

(3) 

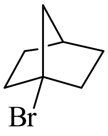
(4) 

(a) 1 > 2 and 3 > 4 (b) 2 > 1 and 3 > 4 (c) 2 > 1 and 4 > 3 (d) 1 > 2 and 4 > 3

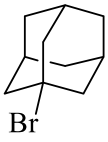
12. The correct order to rate of sololysis in 80% ethanol at 25^0C is– **(June 2018)**



A



B

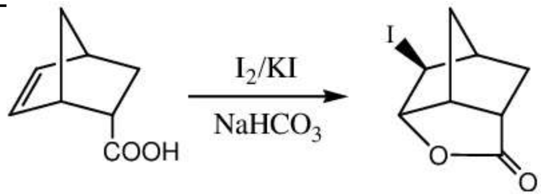


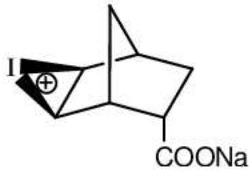
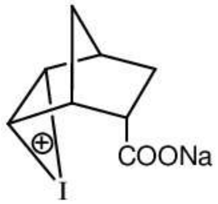
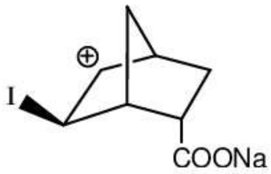
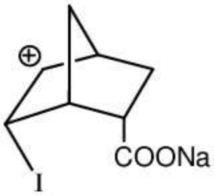
C

(a) B > C > A (b) A > B > C (c) C > B > A (d) C > A > B

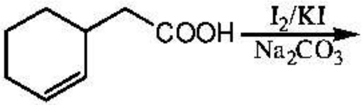
13. The reaction given below proceeds through **(Dec. 2011)**

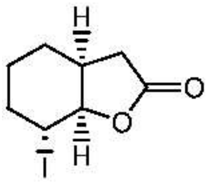
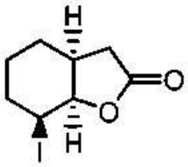
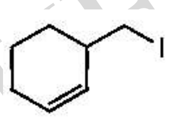
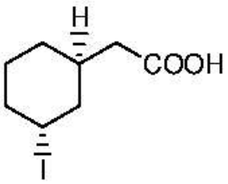
QUANTA CHEMISTRY



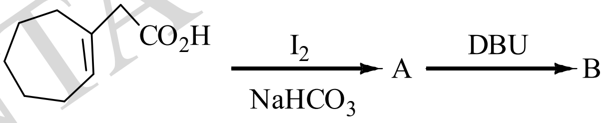
(a)  (b)  (c)  (d) 

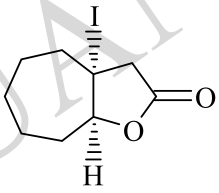
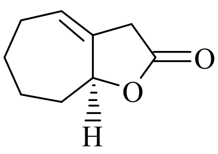
14. The major product formed in the reaction given below is: **(June 2011)**

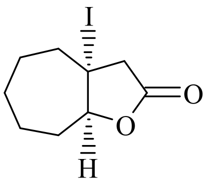
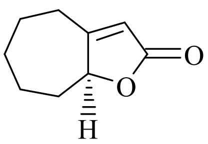


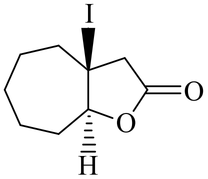
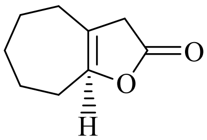
(a)  (b)  (c)  (d) 

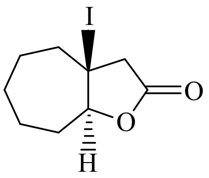
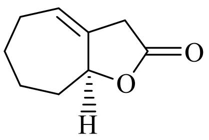
15 Major products A and B of the following reaction sequence are **(Dec. 2017)**



(a) A =  B = 

(b) A =  B = 

(c) A =  B = 

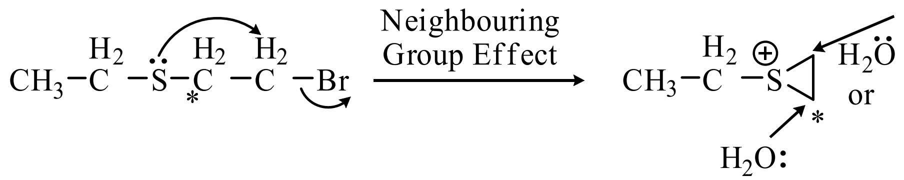
(d) A =  B = 

ANSWER KEY

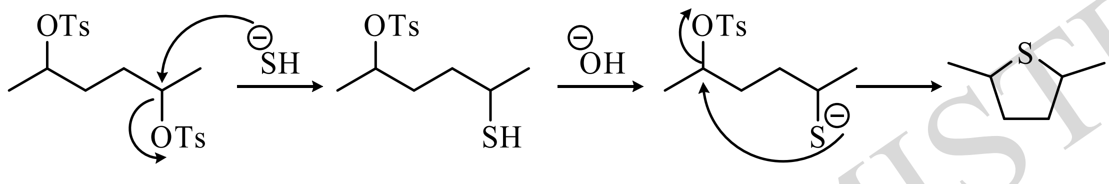
1. c	2. c	3. c	4. d	5. a	6. a	7. b
8. c	9. a	10. **a**	11. d	12. d	13. a	14. a
15. **b**						

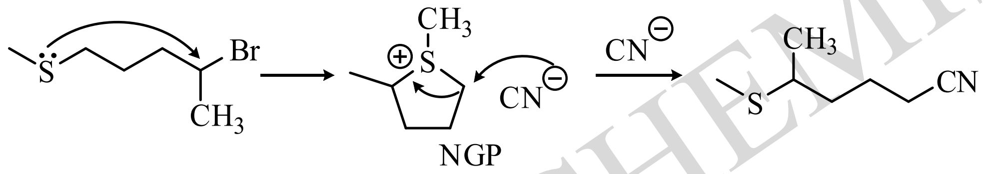
QUANTA CHEMISTRY

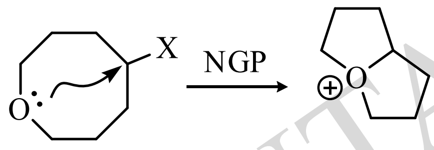
HINTS & SOLUTION

1. 

$\xrightarrow{H_2O} CH_3CH_2-S-\overset{*}{C}H_2CH_2OH + CH_3CH_2-S-CH_2\overset{*}{C}H_2OH$

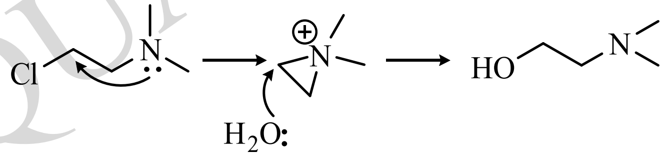
2. 

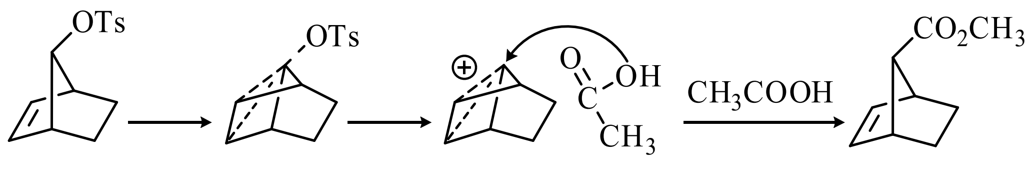
3. 

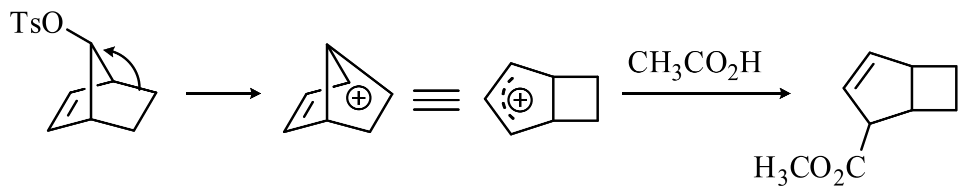
4. 

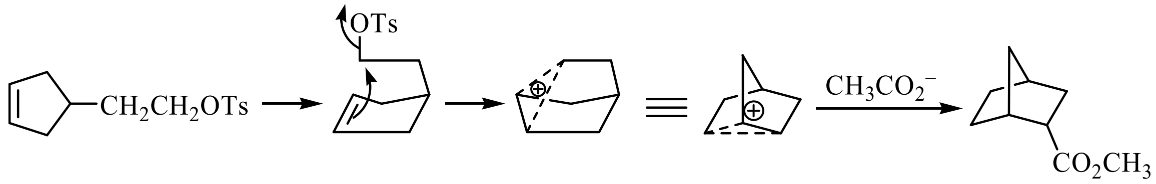
both ring are 5 membered
so fastest

5. Due to NGP, (a) reacts faster



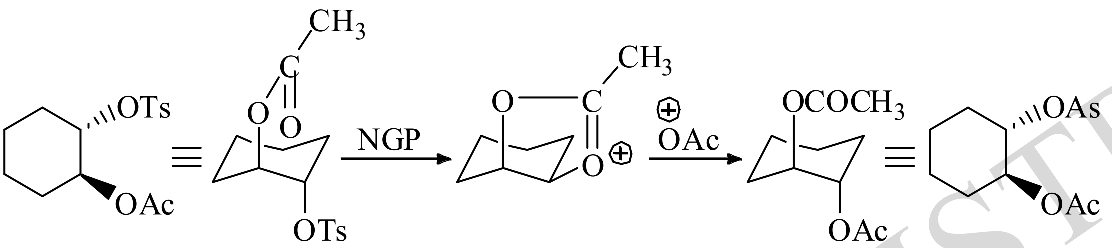
6. 

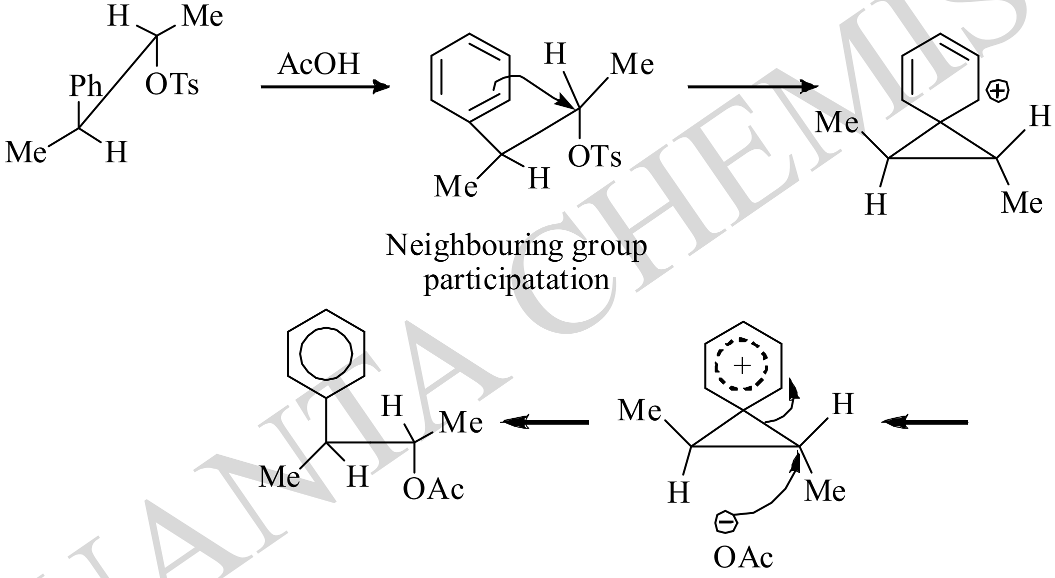
7. 

8. 

CSIR NET Previous Year Questions

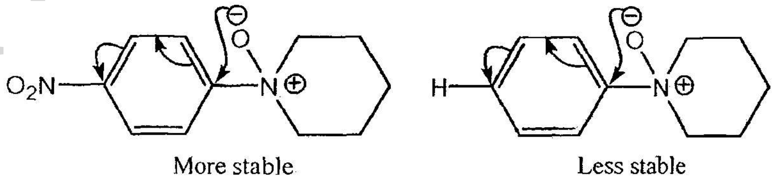
9. (a) See the following reaction.



10. 

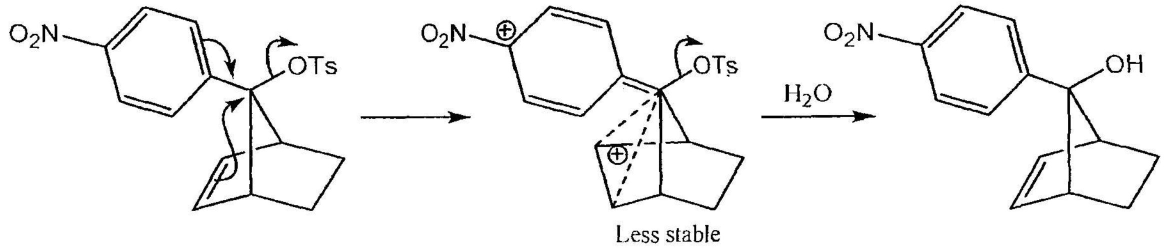
In the presence of neighbouring phenyl group (OTs) depart.

Correct answer is (a)

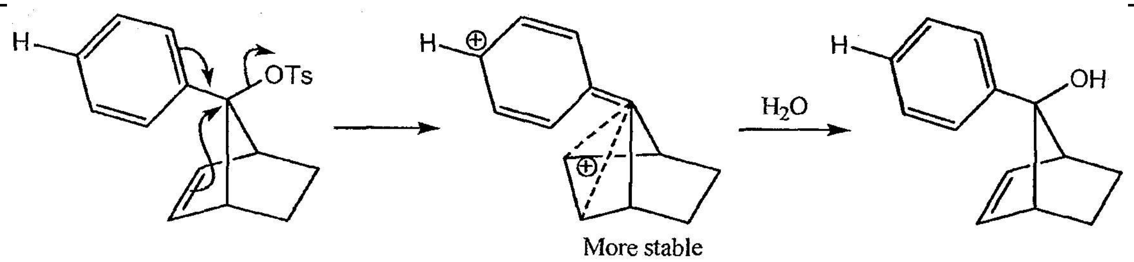
11 

–R effect of this group, increase stability of intermediate.

In that case electron withdrawing group increase the rate of reaction.



EWG containing carbocation intermediate decrease the stability.

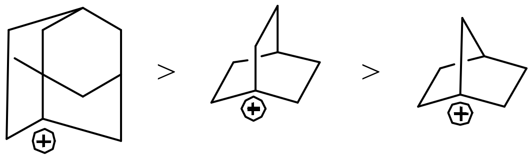


Correct option is (d)

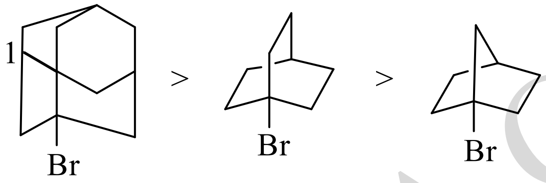
12. (d) Solrolytic reaction is generally Substitution Reaction. It is type of Nucleophli substitution S_N1 or S_N2. Here S_N1 substitutiion Reaction in bridged bicyclic compound - at bridge reacts is very slow or does not take place. This is expected that planer intermediate can not be formed at bridge Head Carbon.

So greater the rigidity about the bridge head lower will bhe reactivity.

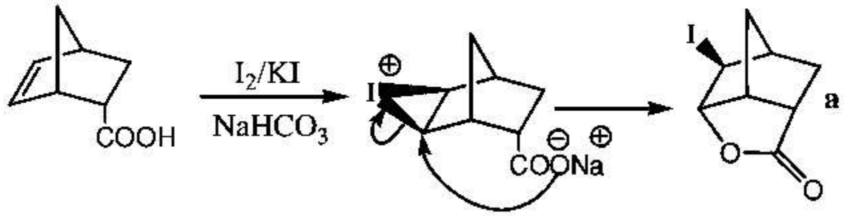
Order of Carbocation Stability.



So - rate of solvolysis -

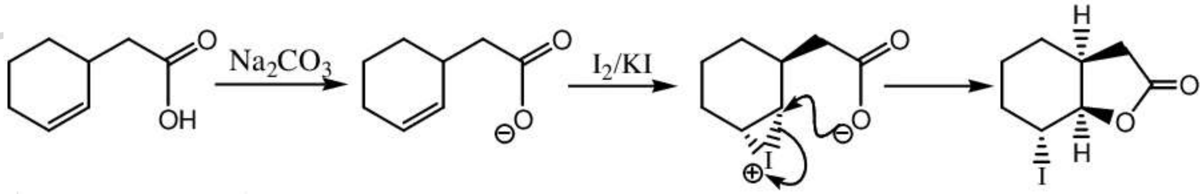


(C) (A) (B)

13. 

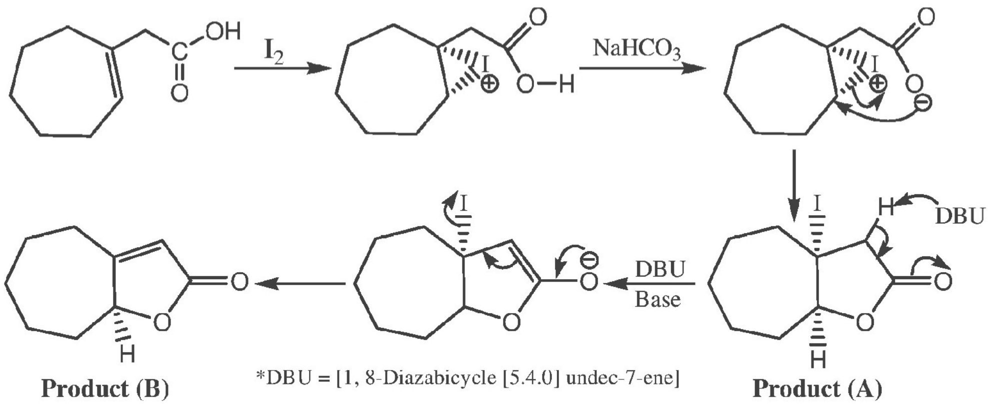
Correct answer is (a)

14. Chemical reaction involved in the above transformation can be illustrated as



Correct answer is (a)

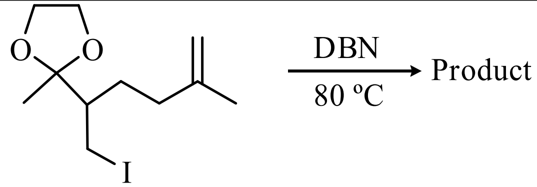
15.



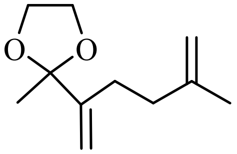
Correct option is (b)

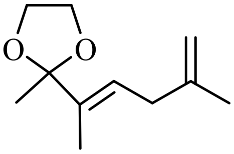
QUANTA CHEMISTRY

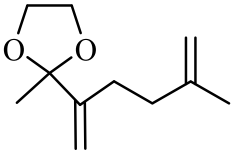
DPP-(5) Reaction Mechanism

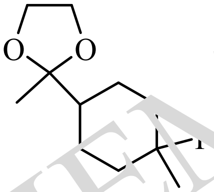
1. 

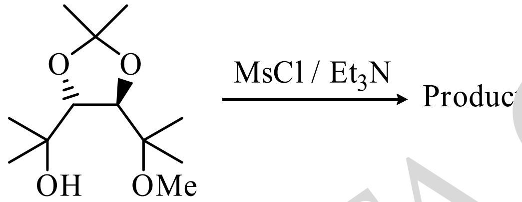
Product and type of reaction is

(a)  ; E_1

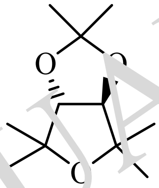
(b)  ; E_1

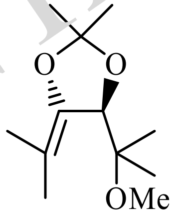
(c)  : E_2

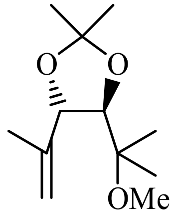
(d)  ; NGP

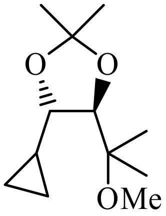
2. 

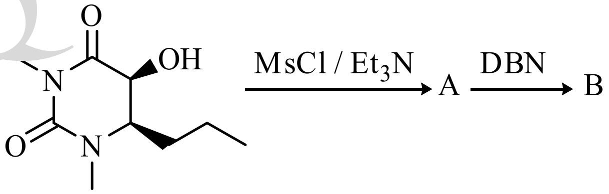
Product is

(a) 

(b) 

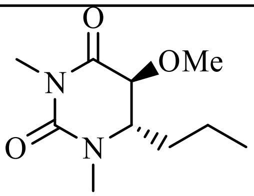
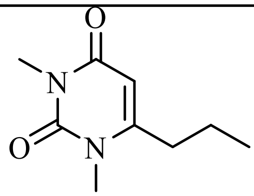
(c) 

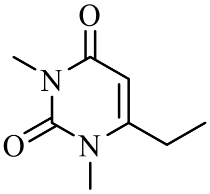
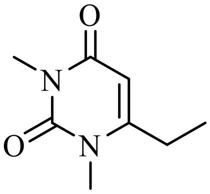
(d) 

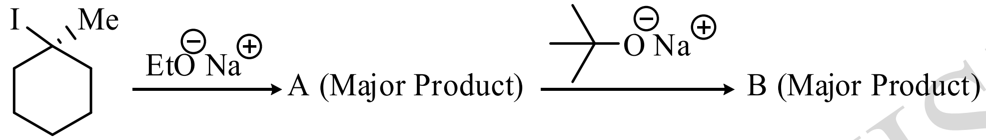
3. 

A or B is

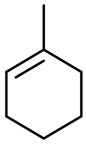
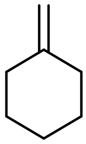
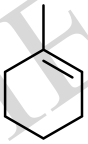
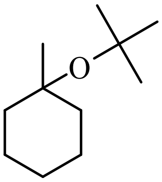
QUANTA CHEMISTRY

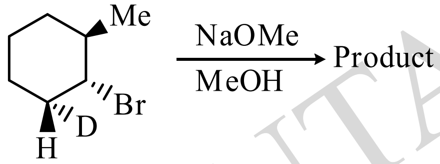
(a) A = 
(b) A = 

(c) A = 
(d) B = 

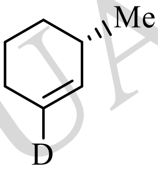
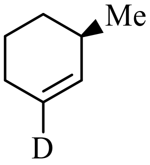
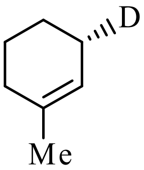
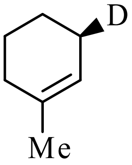
4. 

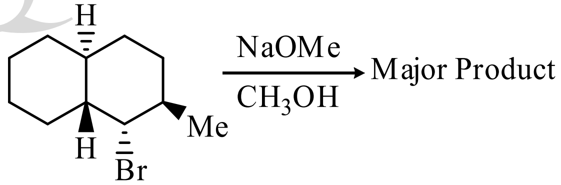
A or B is

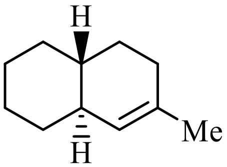
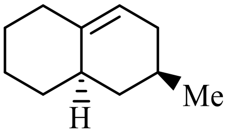
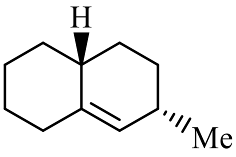
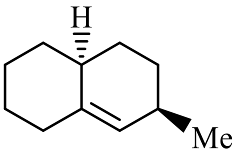
(a) A = 
(b) A = 
(c) B = 
(d) B = 

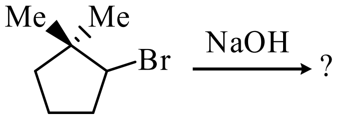
5. 

Major Product is

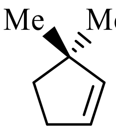
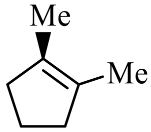
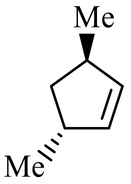
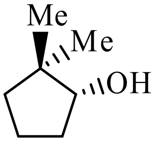
(a) 
(b) 
(c) 
(d) 

6. 

(a) 
(b) 
(c) 
(d) 

7. 

Major Product

(a)  (b)  (c)  (d) 

8. Based on Saytzeff's rule the most stable alkene is

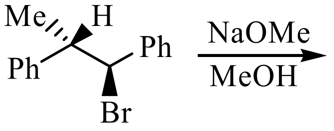
(a) 1 – Methylcyclohexene (b) 3 – Methylcyclohexene

(c) 4 – Methylcyclohexene (d) They are all equally stable

9. Which compound produce only one alkene when treated with sodium ethoxide?

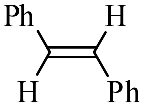
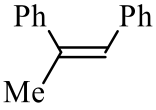
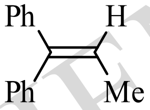
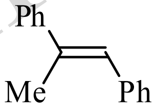
(a) 2 – Chloro – 2 – Methylpentane (a) 2 – Chloro – 3 – Ethylpentane

(c) 3 – Chloro – 2 – Methylpentane (d) 2 – Chloro – 3 – Ethylpentane

10. 

Major Product

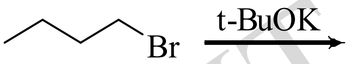
Major Product is

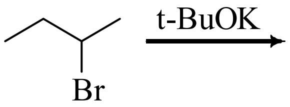
(a)  (b)  (c)  (d) 

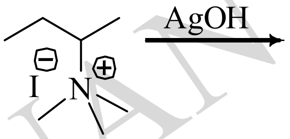
CSIR NET PREVIOUS YEAR QUESTIONS

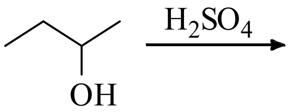
11. Among the following reaction(s) which provide(s) 1-butanes as the major product is (are)

(Dec. 2018)

(A) 

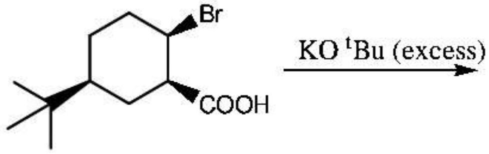
(B) 

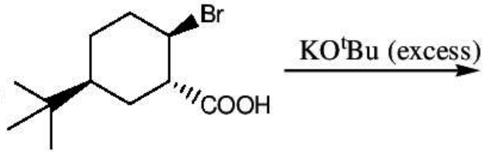
(C) 

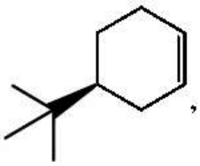
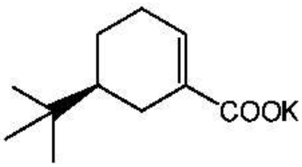
(D) 

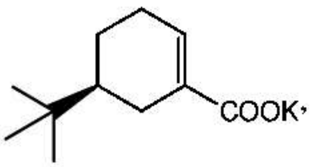
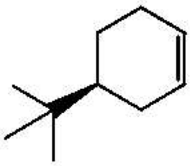
(a) A alone (b) A and B (c) A and C (d) C and D

12. For the following two reactions A and B, the correct statement is: **(June 2012)**

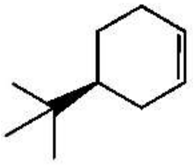
(A) 

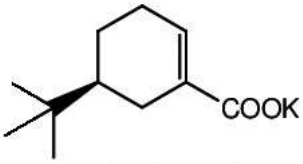
(B) 

(a) A gives , B is 

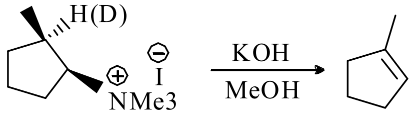
(b) A gives , B is 

QUANTA CHEMISTRY

(c) Both A and B 

(d) Both A and B gives 

13. Deuterium kinetic isotope effect for the following reaction was found to be 4.0. Based on this information, mechanism of the reaction is **(Dec. 2013)**



(a) E_1 (b) E_2 (c) E_{1CB} (d) free radical

14. E_1 reaction is favoured by
(a) Non Polar solvents (b) Strong base
(c) Good learning group (d) Bulky Nucleophile

15. Among the following, poor learning group is

(a) $I^{\ominus}$ (b) $\overset{\ominus}{N}H_2$ (c) $\overset{\ominus}{O}Ts$ (d) $F^{\ominus}$

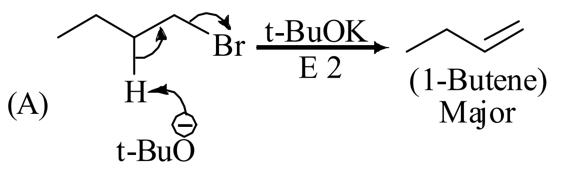
ANSWER KEY

1. c	2. c	3. d	4. a	5. b	6. d	7. a
8. a	9. b	10. b	11. c	12. b	13. b	14.c
15.b						

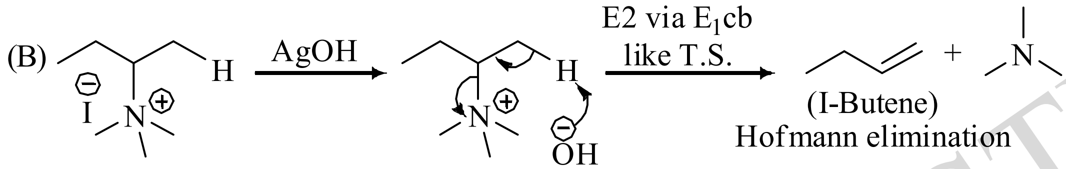
QUANTA CHEMISTRY

HINTS & SOLUTION

11. A and C gives 1-butene, B and D gives 2-butene.



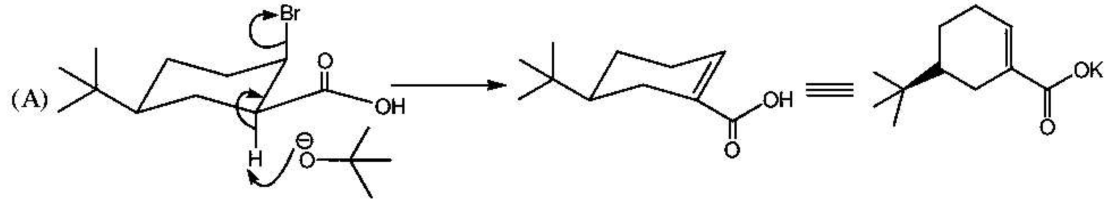
t-BuOK acts as a sterically hindered base, abstract the proton from less hindered sid. Therefore, it gives Hofmann product as a major product



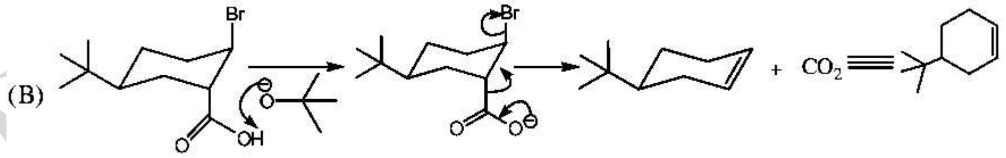
The leaving group quanternary ammonium salt, charge species ti withdraw more electron density from the substrate. It makes the terminal β-hydrogen more acidic and hence it follow transition state having more carbonion tendency. Therefore, Hofmann will be major product.

Correct option is (c)

12. Chemical reaction involved in the above transformation can be illustrated as



Because Br and H are antiperiplanar. So, E_2 elimination will take place.



Correct answer is (b)

13. Kinetic isotope effect is seen in slow step. In case of E_2 – reaction, 'H' or 'D' is involved.

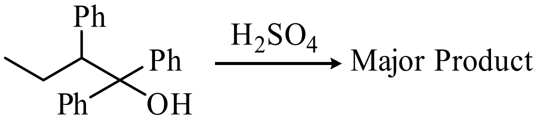
Correct answer is (b)

QUANTA CHEMISTRY

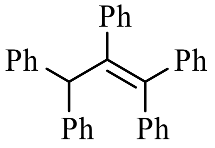
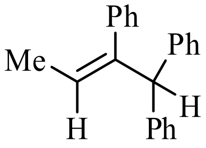
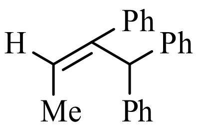
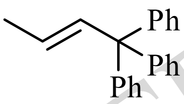
An Institute of Chemical Sciences

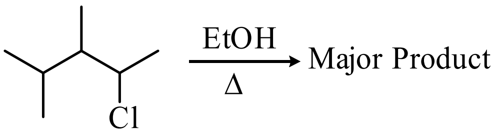
CSIR-NET | IIT-GATE | IIT-JAM | Other MSc. Entrance

DPP-(6) Reaction Mechanism

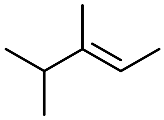
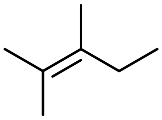
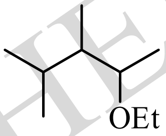
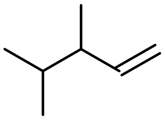
1. 

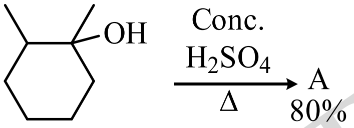
Major product is

(a)  (b)  (c)  (d) 

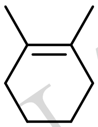
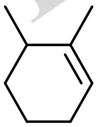
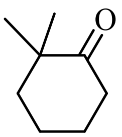
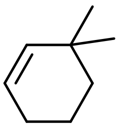
2. 

Major Product is

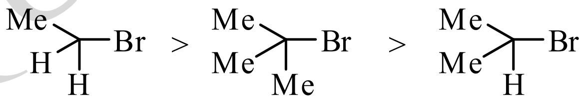
(a)  (b)  (c)  (d) 

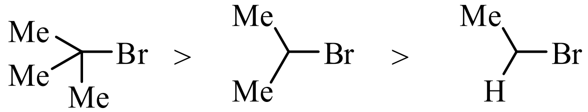
3. 

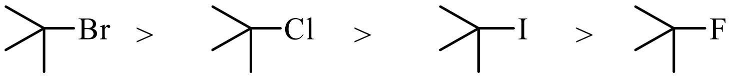
A is

(a)  (b)  (c)  (d) 

4. Reactivity order of alkyl halides in the E_1 reaction is

(a) 

(b) 

(c) 

(d) $CH_3 - F > CH_3 > Cl > CH_3 - Br > CH_3 - I$

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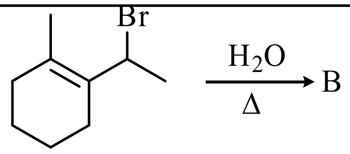
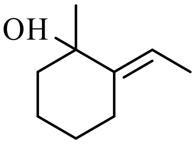
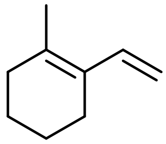
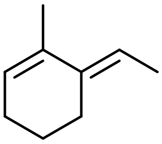
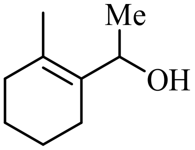
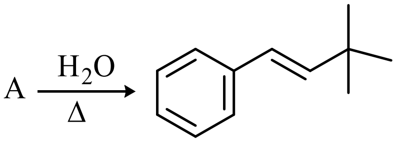
5. 

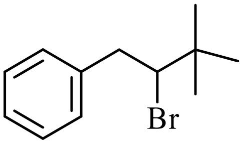
Major Product

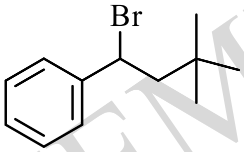
(a) 

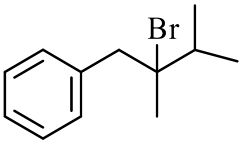
(b) 
(c) 
(d) 

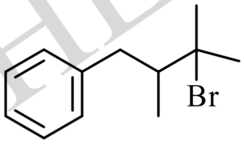
6. 

A is

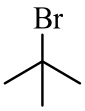
(a) 

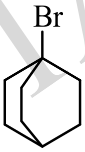
(b) 

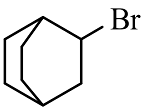
(c) 

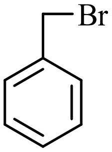
(d) 

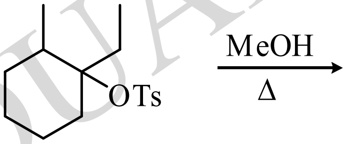
7. E_1 reaction can not be given by

(a) 

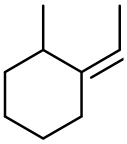
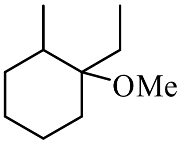
(b) 

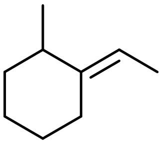
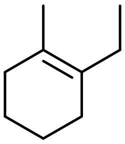
(c) 

(d) 

8.  Major Product

Major Product is

(a) 
(b) 

(c) 
(d) 

ANSWER KEY

1. a 2. b 3. a 4. b 5. c 6. b 7. b
8. d

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